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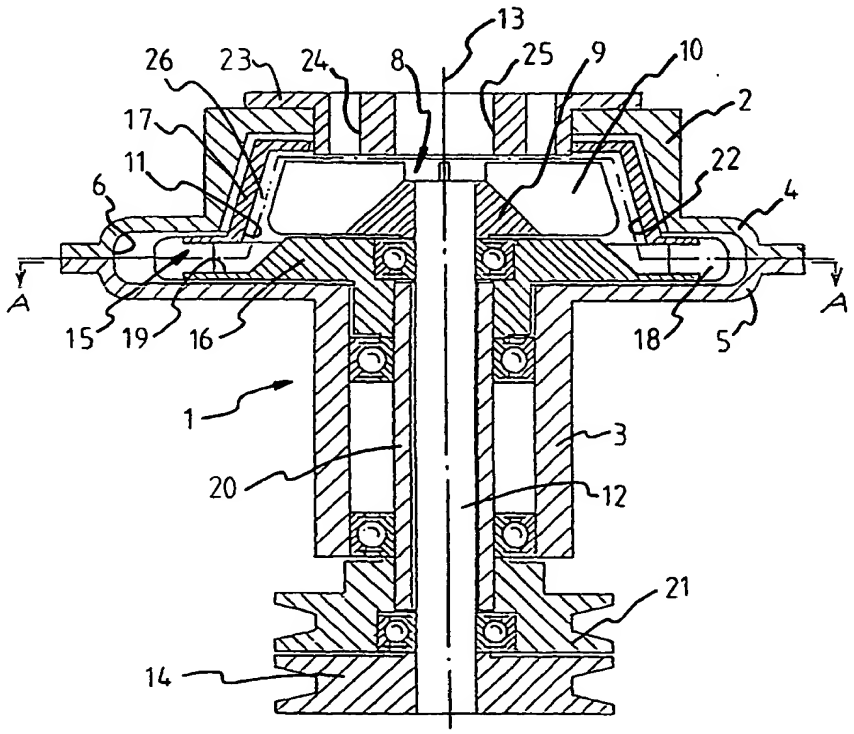
(57) Abstract

A device for continuous mixing of at least two components, such as liquids and/or powders. The device comprises a first means (8, 15) for joining the components in layers, and a second means (6, 18) for discharging the joined components during simultaneous deformation of a layer structure obtained in the joining, to provide a homogeneous mixture of components. The device is characterised in that the first means (8, 15) comprises a layering means (8) and a receiving means (15) rotatable about a longitudinal axis (13) and having a receiving surface (22) which faces the layering means (8) and is arranged radially outside the same. The layering means (8) is adapted to alternately dispose the components in the form of thin layers on the receiving surface (22) to form a stratum of layer structure, and the receiving means (15) is during rotation adapted to support said stratum. The present invention also relates to a method for continuous mixing of at least two components.



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DEVICE AND METHOD FOR CONTINUOUS MIXING

Technical Field

The present invention relates to a device and a method for mixing components, more specifically a device for continuous mixing of at least two components, such as liquids and/or powders, comprising a first means for joining the components in layers, and a second means for discharging the joined components during simultaneous deformation of a layer structure, obtained in the joining, to provide a homogeneous mixture of components, as well as a corresponding method for continuous mixing of at least two components.

Background Art

The most common method of mixing components, such as liquids and/or powders, is to join the components in a vessel and agitate them. This method, however, is not suited for continuous mixing, and moreover the mixing will be random, thereby making it impossible to ensure a homogeneous mixture of components. The result will be largely dependent on the disposition of the components towards mixing.

According to another method, separate partial flows of components are joined to form a common flow, which is then subjected to turbulence. This method certainly admits continuous mixing, but also in this case the mixing will be random and dependent on the disposition of the components towards mixing.

With a view to solving these problems, a method has been developed, which allows continuous and satisfactory mixing of components, and also mixing of components which are not disposed to be mixed. According to this method, the components are joined in layers, and the thus-joined components are then conveyed during deformation of the layer structure obtained in connection with the joining.

As a result, a continuous and homogeneous mixture of components can be obtained.

DE 41 28 999 discloses a device which uses the latter method. The device allows mixing of two components and comprises two annular, narrow ducts, one for each component. The ducts are arranged opposite each other and join each other in a narrow gap. The components are supplied through a duct each, at a relatively high pressure, and are joined in the form of annular layers in the gap, from where the thus-joined components are conducted through one more duct. While flowing in the latter duct, the layer structure obtained in joining is deformed, and a homogeneous mixture of components is obtained. The device allows continuous mixing of components which are not disposed to be mixed, such as oil and water, the oil being supplied at higher pressure than the water to form a dispersion.

However, the device suffers from a number of drawbacks. First, the device does not allow mixing of more than two components. Moreover, the device will not allow mixing of anything but liquid components.

A first object of the present invention therefore is to provide a device which allows continuous mixing of two or more components, which components can be liquids and/or powders. Liquids are intended to comprise also thixotropic and other viscous materials.

A second object of the invention is to provide a method for continuous mixing of two and more components, such as liquids and/or powder. Liquids are again intended to comprise also thixotropic and other viscous materials.

Summary of the Invention

According to the invention, the first object is achieved by a device for continuous mixing according to claim 1. Preferred embodiments of the device are stated in claims 2-16.

According to the invention, the second object is achieved by a method according to claim 17. A preferred embodiment of the method is stated in claim 18.

More specifically, the invention provides a device for continuous mixing of at least two components, such as liquids and/or powders, comprising a first means for joining the components in layers, and a second means for discharging the joined components during simultaneous deformation of a layer structure, obtained in the joining, to provide a homogeneous mixture of components, said device being characterised in that the first means comprises a layering means and a receiving means rotatable about a longitudinal axis and having a receiving surface facing the layering means and being arranged radially outwardly of the layering means, the layering means being adapted to alternately dispose the components in the form of thin layers on the receiving surface to form a stratum of layer structure, and the receiving means, while rotating, being adapted to support said stratum.

The mixing ratio of the components is already determined when joining the components, and thus the mixing ratio is very easy to control by controlling each flow of components to the layering means.

Furthermore, the number of components is not restricted to two, nor it is necessary for the components to be liquid.

By varying the longitudinal extension of the layers of components, i.e. by varying the angular velocity of the receiving means relative to the layering means, the mixing intensity may be varied. A high relative angular velocity between the layering means and the receiving means results in a high mixing intensity, which allows mixing of components which are not disposed to be mixed. This allows, for example, continuous mixing of thixotropic components, such as soft whey-cheese and ordinary soft cheese, which are not disposed to be mixed.

Moreover, continuous mixing of components in various phases is allowed, thereby allowing, for example, mixing of one component in liquid form and one component in pulverulent form.

Said second means acts as stated above to discharge the joined components during simultaneous deformation of the layer structure obtained in joining. A method of achieving this is to let the second means mechanically engage with the layer structure for advancing and for performing a creasing thereof. The second means can also be arranged to conduct the layer structure in a duct while flowing turbulently, which also results in creasing of the layer structure, thus ensuring a homogeneous mixture of components.

The layering means can be rotatable about said longitudinal axis, and preferably the layering means is rotatable with a first angular velocity and the receiving means is rotatable with a second angular velocity differing from the first angular velocity. Moreover, the layering means is advantageously rotatable in a direction of rotation which is opposite to the direction of rotation in which the receiving means is rotatable. This makes it possible to reach a high relative angular velocity between the layering means and the receiving means, which thus allows mixing of components which are not disposed to be mixed.

Preferably, the layering means is rotatable with an angular velocity in the range 30-85 rad/s, and the receiving means is rotatable with an angular velocity in the range 30-85 rad/s.

The layering means may comprise a nozzle for each of the components, each nozzle being adapted to dispose thin layers of the component supplied thereto on the receiving surface.

The layering means can alternatively comprise a blade means which is rotatable about said longitudinal axis and which during rotation thereof is adapted to

engage with the components supplied thereto and subsequently throw them away to dispose thin layers of the components on the receiving surface.

According to a first preferred embodiment of the invention, the receiving means is adapted to transfer the stratum to the second means, and more specifically the receiving means may comprise a body having a conical interior circumferential surface which is concentrically arranged about the longitudinal axis and which thus encloses the layering means and forms said receiving surface, the receiving means, during rotation thereof and under the action of centrifugal forces, being adapted to conduct said stratum towards the wider end of the conical receiving surface, at which end the stratum will be transferred to the second means.

In operation of a thus designed device in which the wider end of the receiving surface is directed downwards, joining of liquid components is allowed. The rotation of the receiving means thus causes centrifugal forces which support the stratum, formed of the components, on the receiving surface and at the same time ensure that the stratum is continuously conducted towards the wider end of the receiving surface to be transferred to the second means. One or more components can also be pulverulent.

Preferably, the second means comprises a helical duct which encloses the receiving means and has a side open towards the receiving means, whereby the stratum continuously transferred from the receiving means will be collected by said duct. The second means may further comprise in unison with the receiving means rotatable discharge means, and the duct may comprise an outlet connected thereto, the discharge means being adapted to convey to the outlet the stratum transferred to the duct during deformation of its layer structure. Preferably each discharge means comprises a vane which is fixed in the receiving means and displaceable in the duct and which during rotation of the receiving means engages with

the stratum transferred to the duct and conveys it during creasing thereof towards the outlet.

According to a second preferred embodiment of the inventive device, the second means comprises a scraper element for scraping off the stratum from the receiving surface, and the receiving means is adapted to transfer, during rotation, the thus-scraped off stratum to a discharge unit of the second means.

Preferably the receiving means comprises a body having a cylindrical, interior circumferential surface which is concentrically arranged about the longitudinal axis and which thus encloses the layering means and forms said receiving surface, and the scraper element is arranged along the receiving surface to scrape off the stratum, said deformation of the stratum being performed during said scraping off.

This allows mixing of pulverulent components, the stratum formed of the components being supported on the receiving surface owing to the centrifugal forces acting on the stratum by means of the rotation of the receiving means.

The scraper element preferably comprises a helical band element which is extended parallel with the longitudinal axis and which is arranged along the cylindrical receiving surface, the band element being rotatable with a third angular velocity differing from said second angular velocity, whereby the stratum formed on the receiving surface, during rotation of the receiving means as well as the band element, is continuously conveyed to a discharge position, from which the stratum will be transferred to the discharge unit of the second means.

Moreover, the present invention provides a method for mixing at least two components, comprising the steps of joining the components in layers, and subsequently conveying the thus-joined components in such manner that a layer structure obtained in the joining is deformed to form a homogeneous mixture of components, said method

being characterised in that the step of joining the components comprises the steps of alternately disposing, with the aid of a layering means, thin layers of the components on a receiving means radially enclosing the layering means to form a stratum of layer structure, and by rotation of the receiving means supporting the stratum, the layers in the circumferential direction being disposed uniformly on the receiving means in consequence of its rotation.

Preferably the receiving means is rotated with a first angular velocity and the layering means is rotated with an angular velocity differing from the angular velocity of the receiving means, whereby the layering means engages with components supplied thereto and throws them in the form of thin layers to the receiving means.

A preferred embodiment of the invention will now for the purpose of exemplification be described with reference to the accompanying Figures.

Brief Description of the Drawings

Fig. 1 is a cross-sectional view of a first embodiment of a device according to the invention.

Fig. 2 is a cross-sectional view of the device along line A-A in Fig. 1.

Fig. 3 is a cross-sectional view of a second embodiment of a device according to the present invention.

Fig. 4 is a cross-sectional view of the device along line A-A in Fig. 3.

Fig. 5 is a cross-sectional view of the device along line B-B in Fig. 3.

Description of Embodiments

A device as shown in Figs 1 and 2, to which reference is made, for continuous mixing according to a first embodiment of the present invention comprises a housing 1, in which a first means for joining components in layers and a second means for discharging the joined

components during simultaneous deformation of a layer structure obtained in the joining are arranged. The first means comprises more specifically a layering means and a receiving means which are concentrically arranged in the housing 1. The second means comprises a helical duct 6 and vane means 18.

The housing 1 comprises an upper housing portion 2 and a lower housing portion 3. The upper housing portion 2 is open at both ends and has a lower flange 4. The lower housing portion 3 is also open at both ends and has an upper flange 5. The flanges 4, 5 abut each other and form the helical duct 6. An outlet pipe 7 shown in Fig. 2 is tangentially connected to the duct 6.

The layering means comprises a layering rotor 8 arranged concentrically in the housing 1 and having a hub 9, which supports four blades 10 arranged perpendicularly to each other. The hub 9 is attached to a first end of a first drive shaft 12 which extends along a central longitudinal axis 13 of the housing 1. A first pulley 14 is fixed to the second end of the first drive shaft 12.

The receiving means comprises a receiving rotor 15 arranged concentrically in the housing 1 and having an essentially planar lower part 16 and a conical upper part 17, the wider end 11 of the upper part 17 being directed downwards. The upper part 17 is supported by the lower part 16 with the aid of the vane means 18 to form an annular gap 19 between the two parts 16, 17. The lower part 16 is fixed to a first end of a second drive shaft 20 which is hollow and extends outside the first drive shaft 12 along the longitudinal axis 13. The second end of the second drive shaft 20 supports a second pulley 21. The lower part 16 and the second pulley 21 are mounted in bearings in the first drive shaft 12.

The two pulleys 14, 21 are, via belts (not shown), connected to drive means (not shown).

The receiving rotor 15 is arranged in the housing 1 in such manner that a conical interior circumferential

surface 22 of the receiving rotor 15 radially encloses the layering rotor 8.

Thus the two rotors 8, 15 are mutually concentric and rotatable relative to each other by means of the first and the second drive shaft 12, 20, respectively.

Furthermore, the second drive shaft 20 is mounted in bearings in the housing 1. Finally a cover 23 with supply openings 24, 25 is mounted in the upper side of the upper housing portion 2.

In operation of the device, the layering rotor 8 and the receiving rotor 15 are driven with the aid of the drive means (not shown). The rotors 8, 15 are rotated with different angular velocities ω_1 and ω_2, respectively, and preferably in different directions of rotation P_1 and P_2, respectively. An example of merely exemplifying angular velocities ω_1 and ω_2 is 30-85 rad/s for each rotor 8, 15. However, it will be appreciated that the angular velocities ω_1 and ω_2 must be adjusted to the components to be mixed, which means that certain components may require both lower and higher angular velocities.

The components to be mixed are supplied to the device through the supply openings 24, 25. Suitably liquid components are supplied through the narrower supply openings 24 and pulverulent components, if any, are supplied through the wider supply opening 25.

The components are conducted to a space 26 which is defined in the housing 1 and in which the blades 10 of the layering rotor 8 are arranged. During rotation, the blades 10 will thus engage with the supplied components and throw thin layers of each component tangentially forwards (seen perpendicular to the plane of rotation of the layering rotor). The thin layers will be collected by and disposed on the interior circumferential surface 22 of the receiving rotor 15. The layers will be disposed essentially alternately and thus form a stratum of layer structure.

The stratum is supported by the receiving rotor 15 owing to its rotation. Moreover, the conical design of the circumferential surface 22 implies that the centrifugal forces acting on the stratum continuously conduct the stratum towards the wider end 11 of the circumferential surface 22. As the stratum reaches this end 11, it will be thrown away through the annular gap 19 and collected by the helical duct 6.

The vane means 18 are arranged in the helical duct 6 and rotate in unison with the receiving rotor 15. The vane means 18 will thus travel in the same duct 6 and engage with the stratum arranged in the duct 6. The stratum is conveyed by the vane means 18, during simultaneous deformation or creasing thereof, to the outlet 7. When the stratum finally reaches the outlet 7, the stratum is consequently worked in such manner that a homogeneous mixture of components has been provided. The second means, i.e. the duct 6 and the vane means 18, thus serves to discharge the stratum having a layer structure while creasing the same by mechanical engagement.

If any of the components is a pulverulent component, it is supplied, as described above, through the wider supply opening 25. The supply opening 25 is arranged essentially centrally in the cover 23. This ensures that the blades 10 of the layering rotor 8 first dispose layers of liquid components, which consequently are supplied through the smaller and radially externally arranged supply openings 24, and subsequently dispose layers of the pulverulent component on the circumferential surface 22. This results in wetting of the circumferential surface 22, which facilitates the disposing of powder layers.

It will be appreciated that the directions of rotation P_1, P_2 of the rotors 8, 15 need not necessarily be opposed. The essential thing is that the requisite relative angular velocity between the rotors 8, 15 is achieved, the requisite relative angular velocity being depen-

dent on the desired mixing intensity. A high relative angular velocity results in the layers being extended in the longitudinal direction, which results in a high mixing intensity.

Thanks to the relative angular velocity between the rotors 8, 15 the layers of components will be disposed uniformly in the circumferential direction on the interior circumferential surface 22 of the receiving rotor 15, even if differences in intensity in the angular direction should arise in the flow of components from the layering rotor 8.

Figs 3-5, to which reference is made, illustrate a device for continuous mixing according to a second preferred embodiment of the present invention.

The device comprises a housing 101, in which a first means for joining components in layers and a second means for discharging the joined components during simultaneous deformation of a layer structure obtained in the joining are arranged. The first means comprises more specifically a layering means and a receiving means. The second means comprises a scraper element in the form of a band element 129. The housing 101 also constitutes part of the second means. The housing 101 has supply openings 125 and an outlet 107, and the layering means and the receiving means are concentrically arranged about a longitudinal axis 113 in said housing 101.

The layering means comprises a layering rotor 108 with two blades 110 which are attached to opposite sides of a first end of a first drive shaft 112, which extends along the longitudinal axis 113 and out through the upper side 127 of the housing 101. The second end of the drive shaft 112 is via a driving assembly (not shown) connected to a drive means (not shown).

The receiving means comprises a receiving rotor 115 formed of a cylindrical part 117 which is supported by a first bottom disc 131. The cylindrical part 117 has an interior circumferential surface 122 which radially

encloses the blades 110 of the layering rotor 108. The cylindrical part 117 further has circumferentially distributed openings 119 in an area in the vicinity of the bottom disc 131, which is clearly to be seen in Fig. 5. The bottom disc 131 is attached to a first end of a second hollow drive shaft 120, which is arranged concentrically with the longitudinal axis 113 and is externally mounted in bearings in a bearing part 133 in the underside 128 of the housing 101. The second drive shaft 120 extends through the underside 128 of the housing 101, and its second end is via a driving assembly (not shown) connected to a drive means (not shown).

The helical band element 129 extended parallel with the longitudinal axis 113 is arranged along the interior circumferential surface 122 of the cylindrical part 117. The band element 129 is supported by struts 130 which in turn are fixed to a second bottom disc 116 which is attached to a first end of a third drive shaft 132 which extends inside the second drive shaft 120 along the longitudinal axis 113. The third drive shaft 132 is externally mounted in bearings in the second drive shaft 120, and its second end is via a driving assembly (not shown) connected to a drive means (not shown).

The layering rotor 108, the receiving rotor 115 and the band element 129 are thus concentrically arranged about the longitudinal axis 113 and rotatable relative to each other. Preferably, the layering rotor 108 is rotatable in a first direction of rotation P_{101} while the receiving rotor 115 and the band element 129 are rotatable in a second direction of rotation P_{102}. Moreover the band element 129 is rotatable with an angular velocity ω_{103} differing from the angular velocity ω_{102} of the receiving rotor 115.

In operation of the device, the layering rotor 108 is thus rotated in a first direction of rotation P_{101} with a first angular velocity ω_{101} while the receiving rotor 115 and the band element 129 are rotated in a second

direction of rotation P_{102} with a second and a third angular velocity ω_{102}, ω_{103}, respectively.

Components, for example in pulverulent form, are supplied to the device via the supply openings 125, the blades 110 engaging with the pulverulent components and alternately disposing layers of the different components on the circumferential surface 122 of the cylindrical part 117. As a result, a stratum of layer structure forms on said circumferential surface 122. Thanks to the relative rotation between the cylindrical part 117 and the band element 129, the stratum will be scraped off from the circumferential surface 122 and conveyed to the area of the cylindrical part 117 with openings 119. During this conveyance, the layer structure of the stratum will be deformed or creased to obtain a homogeneous mixture of components. As the stratum reaches the openings 119, it will be thrown away tangentially forwards under the action of centrifugal forces. The stratum will then be collected by the housing 101 and conducted to the outlet 107, possibly while being continuously deformed or creased.

It will be appreciated that the present invention is not restricted to the embodiments illustrated.

For instance, the band element can be replaced by some other scraper element. The important thing is that the stratum formed on the circumferential surfaces is transferred to the housing and its outlet.

The second means for discharging the joined components during simultaneous deformation of the layer structure obtained in the joining operates by acting mechanically on said layer structure, said second means being described above with reference to the shown embodiments. The vane means 18 in Figs 1 and 2 and the band element 129 in Figs 3 and 4 thus engage with the layer structure and advance the same during simultaneous creasing. However, it will be appreciated that said advancing during simultaneous deformation can be carried out in other man-

ners. For instance, the second means can be arranged to conduct the joined components in a duct while flowing turbulently. Also in this case, the layer structure will be creased, thus obtaining a homogeneous mixture of components.

Moreover, it is possible to replace the layering rotor of the first means with nozzles, which are adapted to dispose a layer of components each on the receiving rotor. The nozzles can either be stationary or rotatable.

It is also possible to turn the receiving rotor described with reference to Figs 1 and 2 in such manner that the wider end is directed upwards. The stratum applied to the receiving surface of the receiving rotor will in any case be conveyed to the wider end because of the centrifugal forces acting on the stratum.

It will finally be appreciated that the number of blades of the layering rotor may vary. The number of layers of components that are disposed on the receiving means per revolution of the layering rotor is partly a function of the number of blades. Thus, the mixing intensity may be affected by varying the number of blades of the layering rotor.

The embodiments illustrated can consequently be modified and changed without departing from the scope of the invention as defined only by the appended claims.

CLAIMS

1. A device for continuous mixing of at least two components, such as liquids and/or powders, comprising

a first means (8, 15; 108, 115) for joining the components in layers, and

a second means (6, 18; 101, 129) for discharging the joined components during simultaneous deformation of a layer structure, obtained in the joining, to provide a homogeneous mixture of components,

c h a r a c t e r i s e d in that the first means (8, 15; 108, 115) comprises

a layering means (8; 108) and

a receiving means (15; 115) rotatable about a longitudinal axis (13; 113) and having a receiving surface (22; 122) facing the layering means (8; 108) and arranged radially outwardly of the same,

the layering means (8; 108) being adapted to alternately dispose the components in the form of thin layers on the receiving surface (22; 122) to form a stratum of layer structure, and

the receiving means (15; 115), while rotating, being adapted to support said stratum.

2. A device as claimed in claim 1, c h a r a c t e r i s e d in that also the layering means (8; 108) is rotatable about said longitudinal axis (13; 113).

3. A device as claimed in claim 2, c h a r a c t e r i s e d in that the layering means (8; 108) is rotatable in a direction of rotation (P_1; P_{101}) which is opposite to the direction of rotation (P_2; P_{102}) in which the receiving means (15; 115) is rotatable.

4. A device as claimed in claim 2 or 3, c h a r a c t e r i s e d in that layering means (8; 108) is rotatable with a first angular velocity (ω_1; ω_{101}), and the receiving means (15; 115) is rotatable with a second

angular velocity (ω_2; ω_{102}) differing from the first angular velocity (ω_1; ω_{101}).

5. A device as claimed in claim 4, characterised in that the first angular velocity (ω_1; ω_{101}) is in the range 30-85 rad/s.

6. A device as claimed in claim 4 or 5, characterised in that the second angular velocity (ω_2; ω_{102}) is in the range 30-85 rad/s.

7. A device as claimed in any one of the preceding claims, characterised in that the layering means comprises a nozzle for each of the components, each nozzle being adapted to dispose thin layers of the component supplied thereto on the receiving surface (22; 122).

8. A device as claimed in any one of claims 2-6, characterised in that the layering means (8; 108) comprises a blade means (10; 110) which is rotatable about said longitudinal axis (13; 113) and which during rotation is adapted to engage with the components supplied thereto and subsequently throw them away to dispose thin layers of the components on the receiving surface (22; 122).

9. A device as claimed in any one of the preceding claims, characterised in that the receiving means (15) is adapted to transfer the stratum to the second means (6, 18).

10. A device as claimed in claim 9, characterised in that the receiving means (15) comprises a body (17) having a conical interior circumferential surface (22) arranged concentrically about the longitudinal axis (13) and thus enclosing the layering means (8) and forming said receiving surface (22), the receiving means (15), during rotation and under the action of centrifugal forces, being adapted to convey said stratum towards the wider end (11) of the conical receiving surface (22), at which end (11) the stratum will be transferred to the second means (6, 18) in consequence of the rotation of the receiving means (15).

11. A device as claimed in claim 10, characterised in that the second means (6, 18) comprises a helical duct (6) which encloses the receiving means (15) and has a side open towards the receiving means (15), whereby the stratum continuously transferred from the receiving means (15) will be collected by said duct (6).

12. A device as claimed in claim 11, characterised in that the second means (6, 18) comprises in unison with the receiving means (15) rotatable discharge means (18), and that the duct (16) comprises an outlet connected thereto, the discharge means (18) being adapted to convey to the outlet (7) the stratum transferred to the duct (6) during deformation of its layer structure.

13. A device as claimed in claim 12, characterised in that each discharge means (18) comprises a vane (18) which is attached to the receiving means (15) and displaceable in the duct (6) and which during rotation of the receiving means (15) engages with the stratum transferred to the duct (6) and conveys it during simultaneous creasing thereof towards the outlet (7).

14. A device as claimed in any one of claims 1-8, characterised in that the second means (101, 129) comprises a scraper element (129) for scraping off the stratum from the receiving surface (122), and that the receiving means (115) is adapted to transfer, during rotation thereof, the thus scraped-off stratum to a discharge unit (101) of the second means (101, 129).

15. A device as claimed in claim 14, characterised in that the receiving means (115) comprises a body (117) having a cylindrical interior circumferential surface (122) which is concentrically arranged about the longitudinal axis (113) and which thus encloses the layering means (108) and forms said receiving surface (122), and that the scraper element (129) is arranged along the receiving surface (122) for scraping off the

stratum from the receiving surface (122), said deformation of the stratum being provided during said scraping off.

16. A device as claimed in claim 15, c h a r a c t e r i s e d in that the scraper element (129) comprises a helical band element (129) which is extended parallel with the longitudinal axis (113) and which is arranged along the cylindrical receiving surface (122), the receiving means (115) being rotatable with a second angular velocity and the band element (129) being rotatable about the longitudinal axis (113) with a third angular velocity (ω_{103}) differing from said second angular velocity (ω_{102}), whereby the stratum formed on the receiving surface (122), during rotation of the receiving means (122) as well as the band element (129), is continuously conveyed to a discharge position (119) from which the stratum will be transferred to the discharge unit (101) of the second means (101, 129).

17. A method for mixing at least two components, comprising the steps of

joining the components in layers, and

subsequently conveying the thus-joined components in such manner that a layer structure obtained in connection with the joining is deformed to form a homogeneous mixture of components,

c h a r a c t e r i s e d in that

the step of joining the components comprises the steps of

alternately disposing, with the aid of a layering means (8; 108), thin layers of the components on a receiving means (15; 115) radially enclosing the layering means (8; 108) to form a stratum of layer structure, and

by rotation of the receiving means (15; 115) supporting the stratum,

the layers in the circumferential direction being distributed uniformly on the receiving means (15; 115) in consequence of its rotation.

18. A method as claimed in claim 17, characterised by the steps of rotating the layering means (8; 108) with a first angular velocity (ω_1; ω_{101}), and rotating the receiving means (15; 115) with an angular velocity (ω_2; ω_{102}) differing from the angular velocity (ω_1; ω_{101}) of the layering means (8; 108), whereby the layering means (8; 108) engages with components supplied thereto and throws them in the form of thin layers to the receiving means (15; 115).

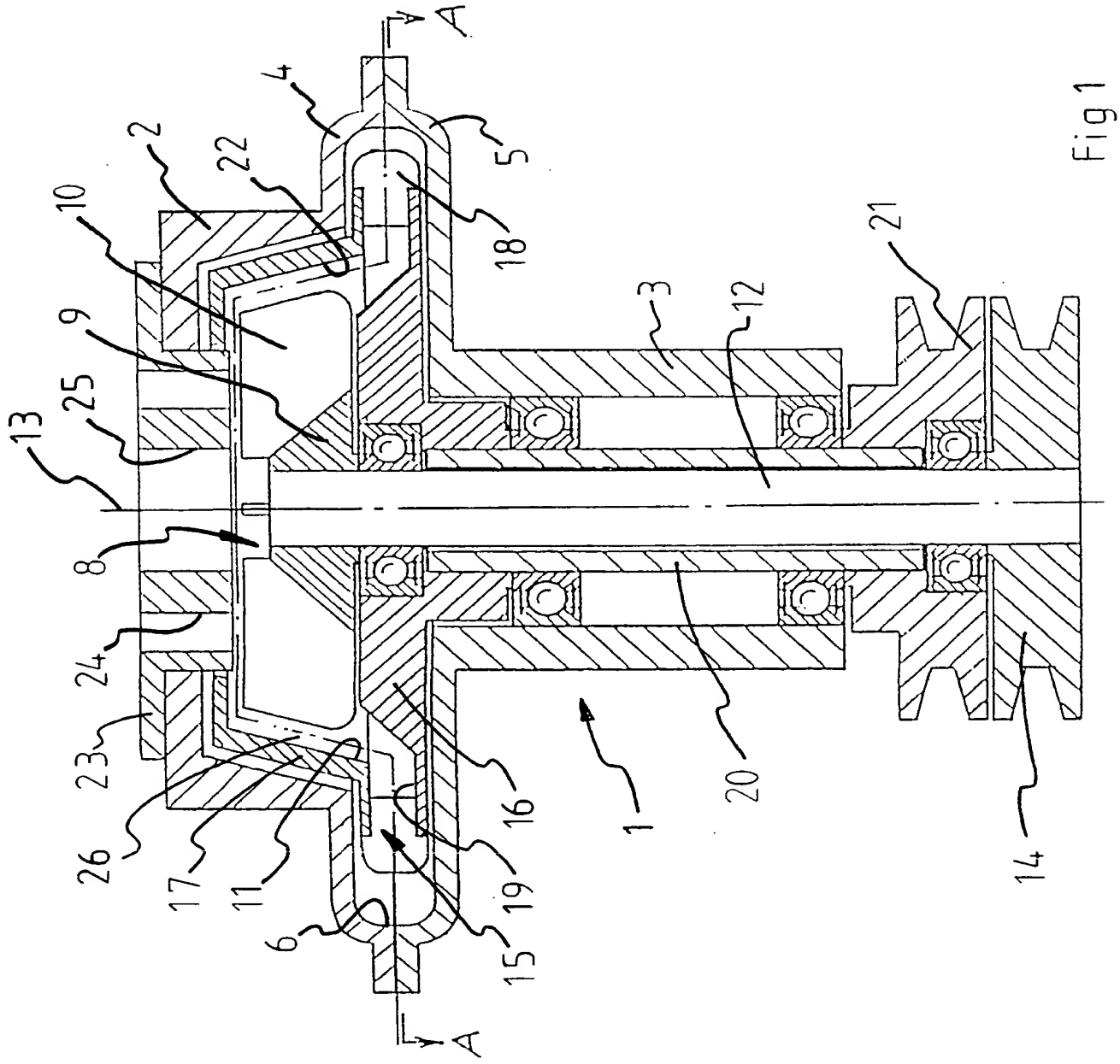

Fig 1

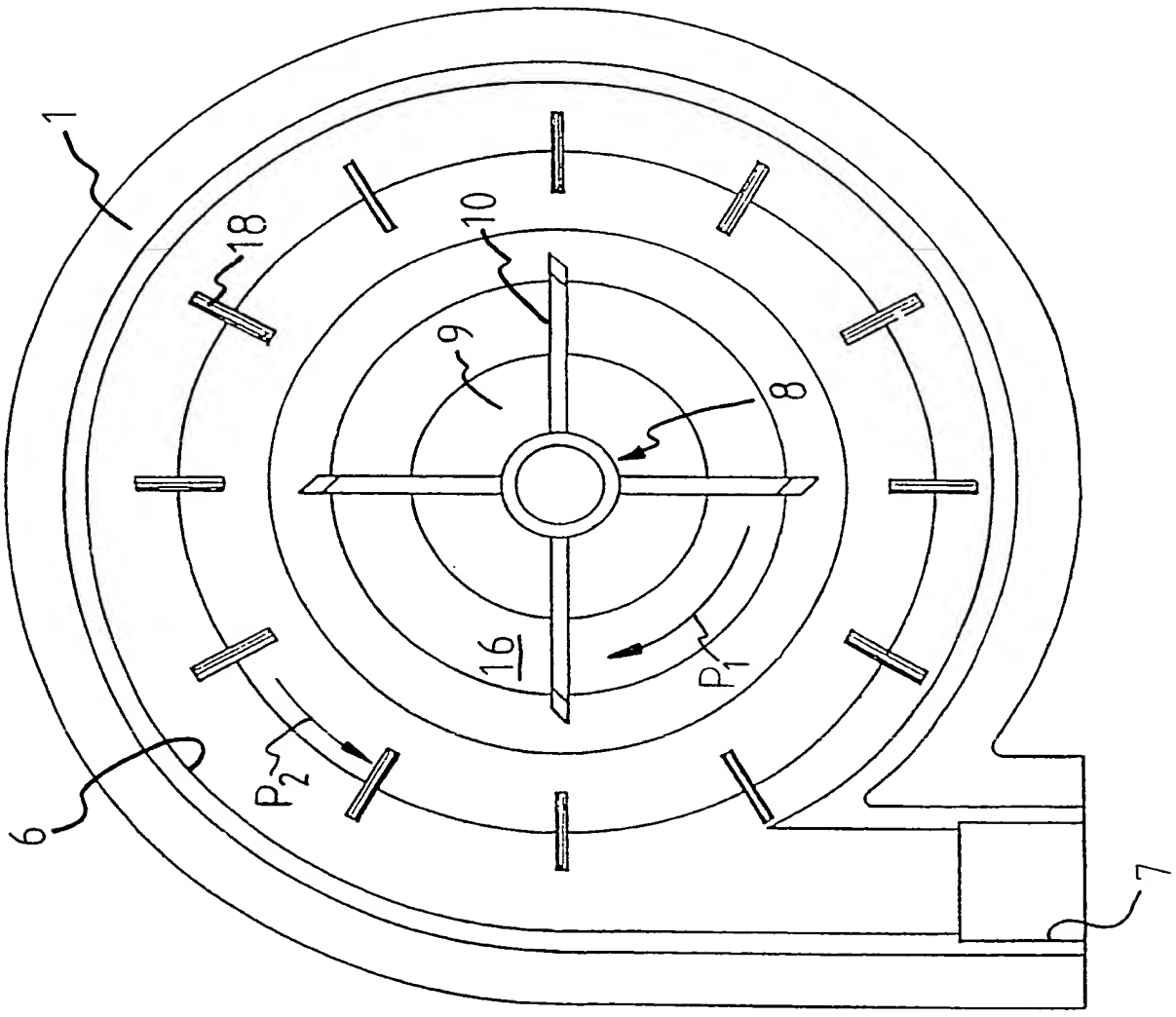

Fig 2

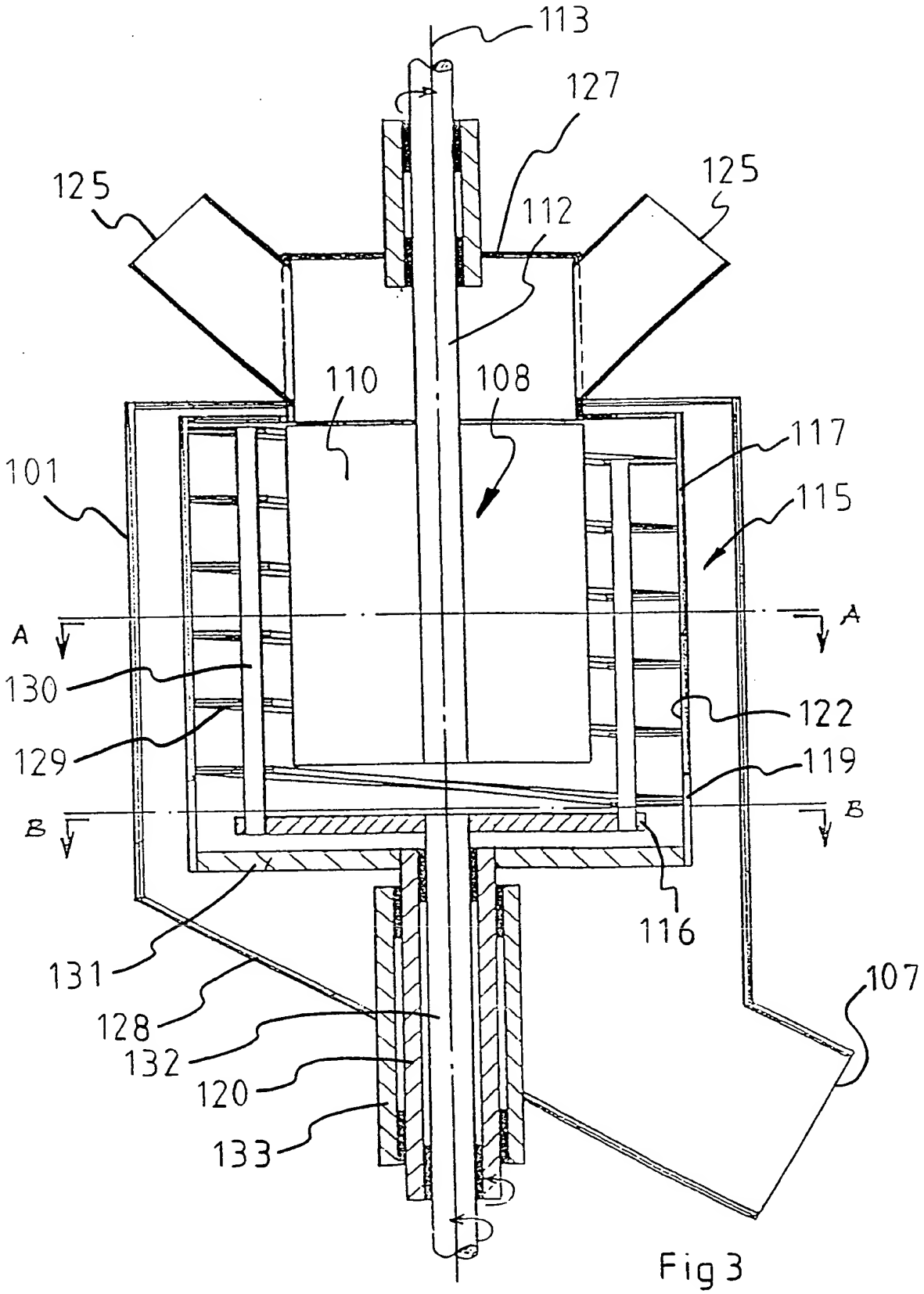
113
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Fig 3

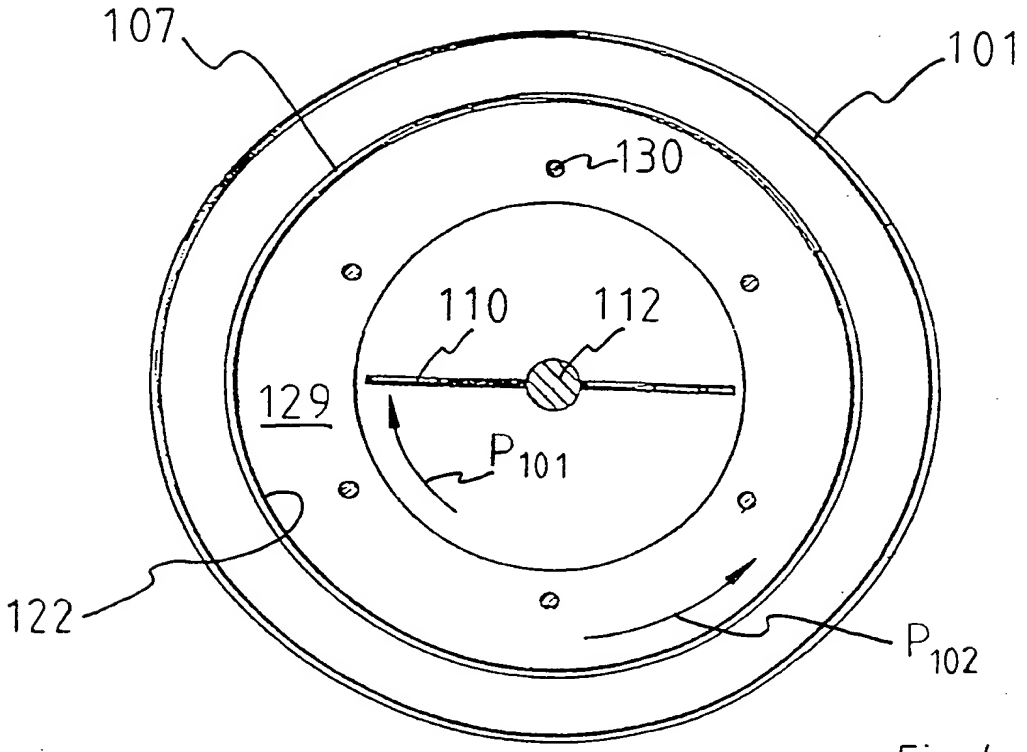

Fig 4

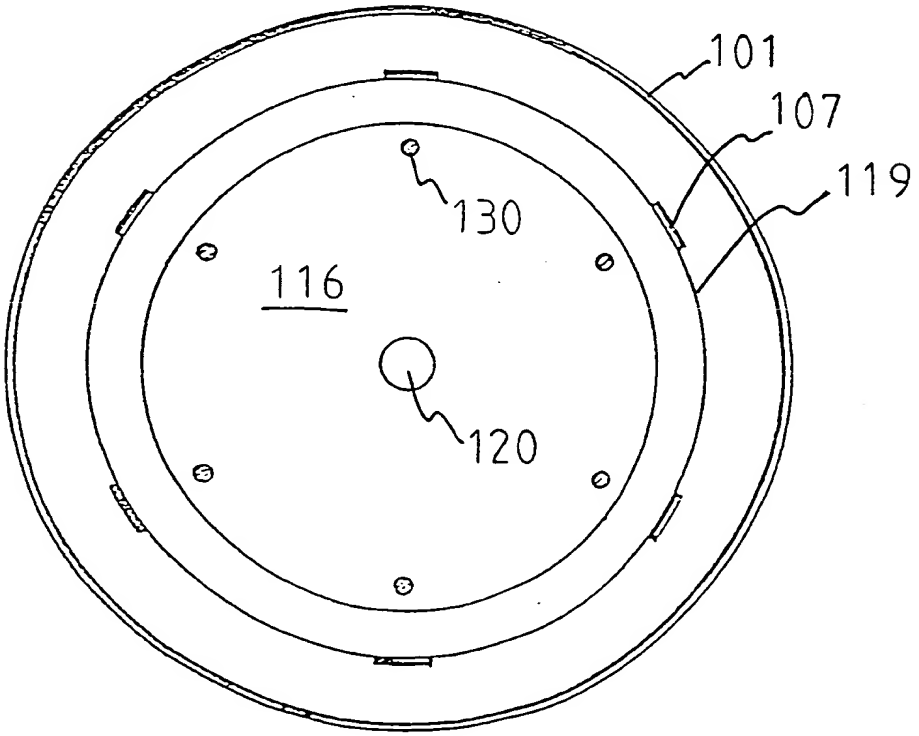

Fig 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/02385

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B01F 3/08, B01F 3/12, B01F 3/18
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, PAJ, US FULLTEXT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0048312 A1 (IVARSON, NEMO), 31 March 1982 (31.03.82), page 3, line 28 - page 4, line 16, figures 1-3, claim 1 -- --------	1,17

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 March 2000	03 -05- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Wiva Asplund/ELY Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SE 99/02385

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0048312 A1	31/03/82	NONE	

TENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
PC-2004158		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/SE99/02385	16.12.1999	21.12.1998
International Patent Classification (IPC) or national classification and IPC_7		
B 01 F 3/08, B 01 F 3/12, B 01 F 3/18		
Applicant		
GLOBAL POWDER AB et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
20.07.2000	20.12.2000
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88 Telex 17978 PATOREG-S	Authorized officer Wiva Asplund/ELY Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/SE99/02385

I. Basis of the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed

☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language english which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☒ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/SE99/02385

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-18	YES
	Claims		NO
Inventive step (IS)	Claims	1-18	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-18	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The claimed invention relates to an apparatus and a method for continuous mixing of at least two components. The apparatus includes a first means for joining the components in layers and a second means for discharging and simultaneous deformation of the layer structure, obtained in the joining. The first means comprises a layering means and a rotatable receiving means having a receiving surface arranged radially outwardly of the layering means. The components are disposed in the form of thin layers on the receiving surface to form a stratum of layer structure and the rotating receiving means is adapted to support the stratum.

Cited EP 0048312 A1 discloses a method and an apparatus for continuously mixing a liquid and a powder. In the apparatus the liquid is formed as a curtain of microscopic droplets in which the powder is thrown. The liquid and powder are thrown together towards the periphery of the apparatus and are caught by mixer pins to form a homogenous mixture.

The cited document does not disclose that a stratum of layer structure is formed on a rotating receiving means and then deformed to produce a homogeneous mixture of components, such as liquids and/or powders. Liquids are intended to comprise also thixotropic and other viscous materials.

Therefore, the claimed invention is novel, is considered to involve an inventive step and to be industrially applicable.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/02385

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B01F 3/08, B01F 3/12, B01F 3/18
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, PAJ, US FULLTEXT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0048312 A1 (IVARSON, NEMO), 31 March 1982 (31.03.82), page 3, line 28 - page 4, line 16, figures 1-3, claim 1-AA -- --------	1,17

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw douhts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 March 2000	03 -05- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Wiva Asplund/ELY Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

RECORD COPY

PCT
REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty

For receiving Office use only

PCT/SE99/02385
International Application No.

16 -12- 1999
International Filing Date

The Swedish Patent Office
PCT International Application
Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired)(12 characters maximum)* 2004158

Box No. I TITLE OF INVENTION

DEVICE AND METHOD FOR CONTINUOUS MIXING.

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

GLOBAL POWDER AB
Vesslevägen 13 A
SE-183 40 TÄBY
Sweden

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: Sweden

State *(that is, country)* of residence: Sweden

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR /FURTHER INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

ANDERSSON, Alf
Box 23
SE-269 35 ÖDÅKRA
Sweden

This person is:

☐ applicant only
☒ applicant and inventor
☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: Sweden

State *(that is, country)* of residence: Sweden

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below ~~is hereby~~/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

AWAPATENT AB
Box 5117
SE-200 71 MALMÖ
SWEDEN

Telephone No.
+46 40 98 51 00

Facsimile No.
+46 40 26 05 16

Teleprinter No.

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent

Box No. V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

- ☐ **AP** **ARIPO Patent:** **GH** Ghana, **GM** Gambia, **KE** Kenya, **LS** Lesotho, **MW** Malawi, **SD** Sudan, **SL** Sierra Leone, **SZ** Swaziland, **UG** Uganda, **ZW** Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☐ **EA** **Eurasian Patent:** **AM** Armenia, **AZ** Azerbaijan, **BY** Belarus, **KG** Kyrgyzstan, **KZ** Kazakhstan, **MD** Republic of Moldovia, **RU** Russian Federation, **TJ** Tajikistan, **TM** Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP** **European Patent:** **AT** Austria, **BE** Belgium, **CH and LI** Switzerland and Liechtenstein, **CY** Cyprus, **DE** Germany, **DK** Denmark, **ES** Spain, **FI** Finland, **FR** France, **GB** United Kingdom, **GR** Greece, **IE** Ireland, **IT** Italy, **LU** Luxembourg, **MC** Monaco, **NL** Netherlands, **PT** Portugal, **SE** Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☐ **OA** **OAPI Patent:** **BF** Burkina Faso, **BJ** Benin, **CF** Central African Republic, **CG** Congo, **CI** Côte d'Ivoire, **CM** Cameroon, **GA** Gabon, **GN** Guinea, **GW** Guinea-Bissau, **ML** Mali, **MR** Mauritania, **NE** Niger, **SN** Senegal, **TD** Chad, **TG** Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)*

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

☐	**AE**	United Arab Emirates	☐	**LR**	Liberia
☐	**AL**	Albania	☐	**LS**	Lesotho
☐	**AM**	Armenia	☐	**LT**	Lithuania
☐	**AT**	Austria +Utility Model	☐	**LU**	Luxembourg
☐	**AU**	Australia	☐	**LV**	Latvia
☐	**AZ**	Azerbaijan	☐	**MD**	Republic of Moldova
☐	**BA**	Bosnia and Herzegovina	☐	**MG**	Madagascar
☐	**BB**	Barbados	☐	**MK**	The former Yugoslav Republic of Macedonia
☐	**BG**	Bulgaria			
☐	**BR**	Brazil	☐	**MN**	Mongolia
☐	**BY**	Belarus	☐	**MW**	Malawi
☐	**CA**	Canada	☐	**MX**	Mexico
☐	**CH and LI**	Switzerland and Liechtenstein	☒	**NO**	Norway
☐	**CN**	China	☐	**NZ**	New Zealand
☐	**CU**	Cuba	☐	**PL**	Poland
☐	**CZ**	Czech Republic +Utility Model	☐	**PT**	Portugal
☐	**DE**	Germany +Utility Model	☐	**RO**	Romania
☐	**DK**	Denmark +Utility Model	☐	**RU**	Russian Federation
☐	**EE**	Estonia +Utility Model	☐	**SD**	Sudan
☐	**ES**	Spain	☐	**SE**	Sweden
☐	**FI**	Finland +Utility Model	☐	**SG**	Singapore
☐	**GB**	United Kingdom	☐	**SI**	Slovenia
☐	**GD**	Grenada	☐	**SK**	Slovakia +Utility Model
☐	**GE**	Georgia	☐	**SL**	Sierra Leone
☐	**GH**	Ghana	☐	**TJ**	Tajikistan
☐	**GM**	Gambia	☐	**TM**	Turkmenistan
☐	**HR**	Croatia	☐	**TR**	Turkey
☐	**HU**	Hungary	☐	**TT**	Trinidad and Tobago
☐	**ID**	Indonesia	☐	**UA**	Ukraine
☐	**IL**	Israel	☐	**UG**	Uganda
☐	**IN**	India	☒	**US**	United States of America
☐	**IS**	Iceland			
☒	**JP**	Japan	☐	**UZ**	Uzbekistan
☐	**KE**	Kenya	☐	**VN**	Viet Nam
☐	**KG**	Kyrgyzstan	☐	**YU**	Yugoslavia
☐	**KP**	Democratic People's Republic of Korea	☐	**ZA**	South Africa
			☐	**ZW**	Zimbabve
☐	**KR**	Republic of Korea			
☐	**KZ**	Kazakhstan			
☐	**LC**	Saint Lucia			
☐	**LK**	Sri Lanka			

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

☐ ☐

☐ ☐

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)*

Sheet No. 3

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplement Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) 21 December 1998 (21.12.1998)	9804442-3	Sweden		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): (1)

** Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(If two or more International Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):*

ISA / SE

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):*

Date (day/month/year)	Number	Country (or regional Office)
21 December 1998	SE 98/01469	Sweden

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets:**

request	: 3 ✓
description (excluding sequence listing part)	: 14 ✓
claims	: 5 ✓
abstract	: 1 ✓
drawings	: 4 ✓
sequence listing part of description	:
Total number of sheets	: 27 ✓

This international application is **accompanied by** the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference No., if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international applications into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listning in computer readable form
9. ☒ other (specify): Official Letter

Figure of the drawings which should accompany the abstract: 1

Language of filing of the international application: Swedish

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Jan-Åke Åkesson

For receiving Office use only

1.	Date of actual receipt of the Purported international application: 16 -12- 1999	2. Drawings: ☒ received: ☐ not received:
3.	Corrected date of actual receipt due to later but Timely received papers or drawings completing the purported international application:	
4.	Date of timely receipt of the required Corrections under PCT Article 11(2):	
5.	International Searching Authority (if two or more are competent): ISA/ SE	6. ☐ Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy by the International Bureau: 04 FEBRUARY 2000 (04.02.00)

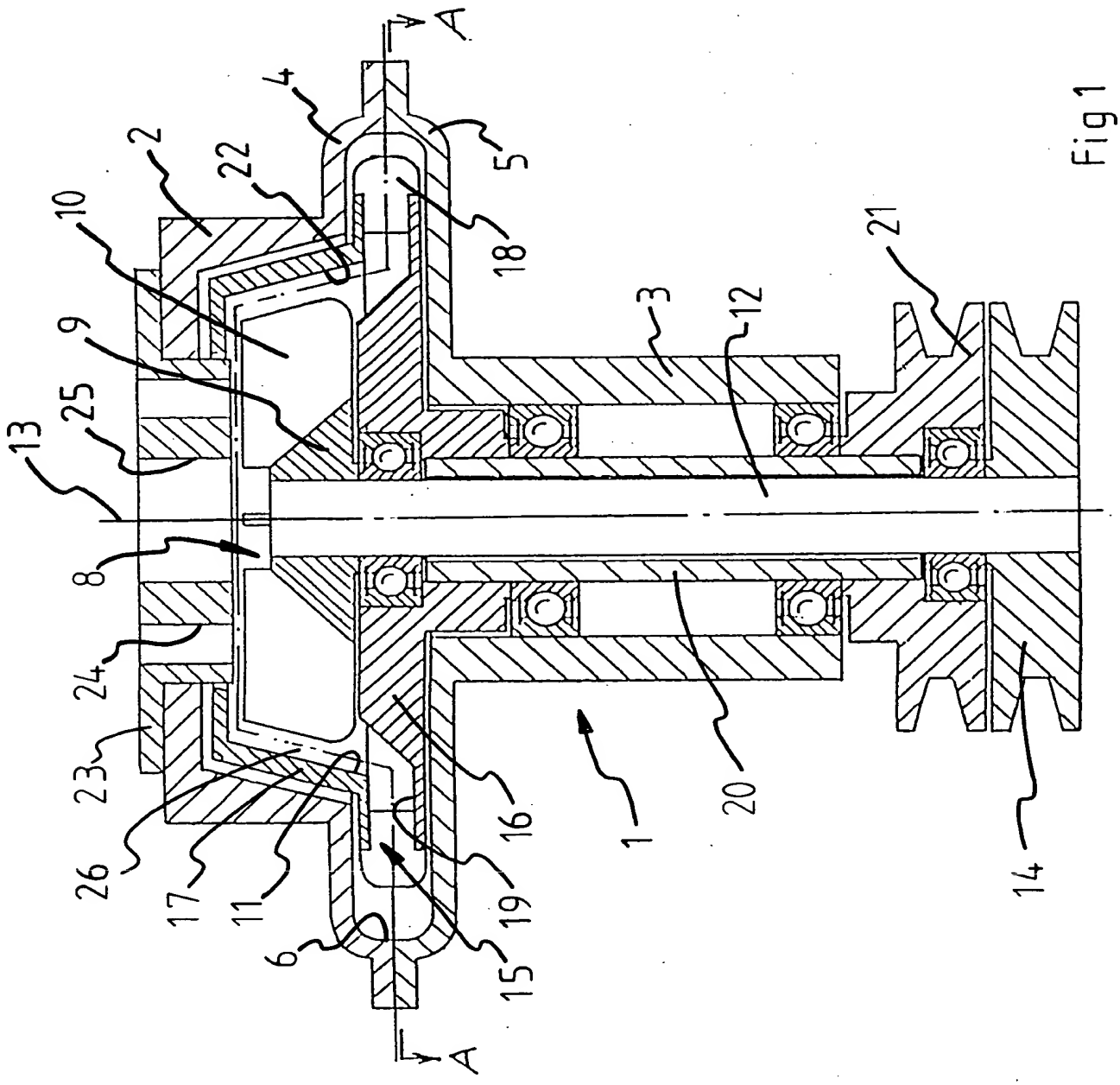

Fig 1

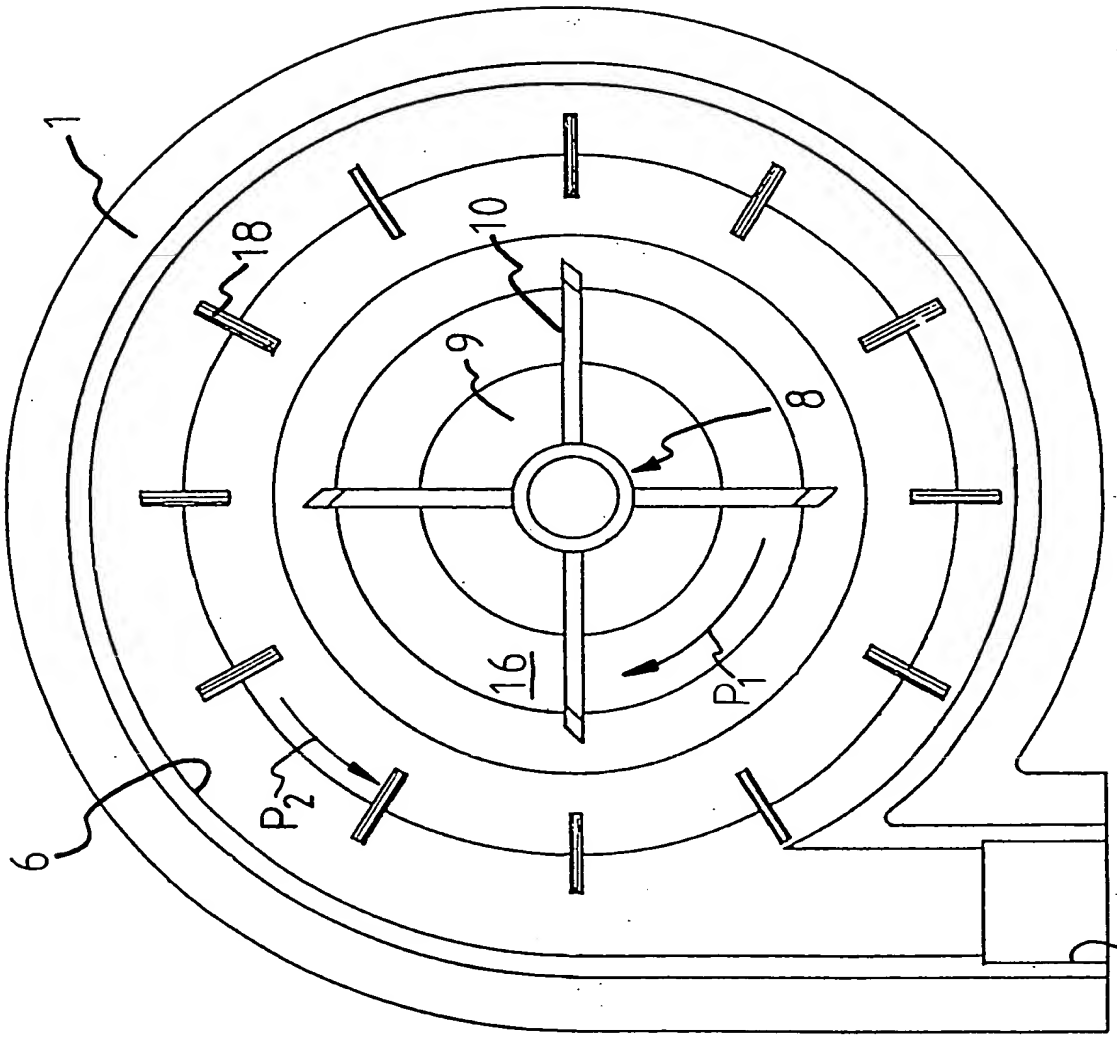

Fig 2

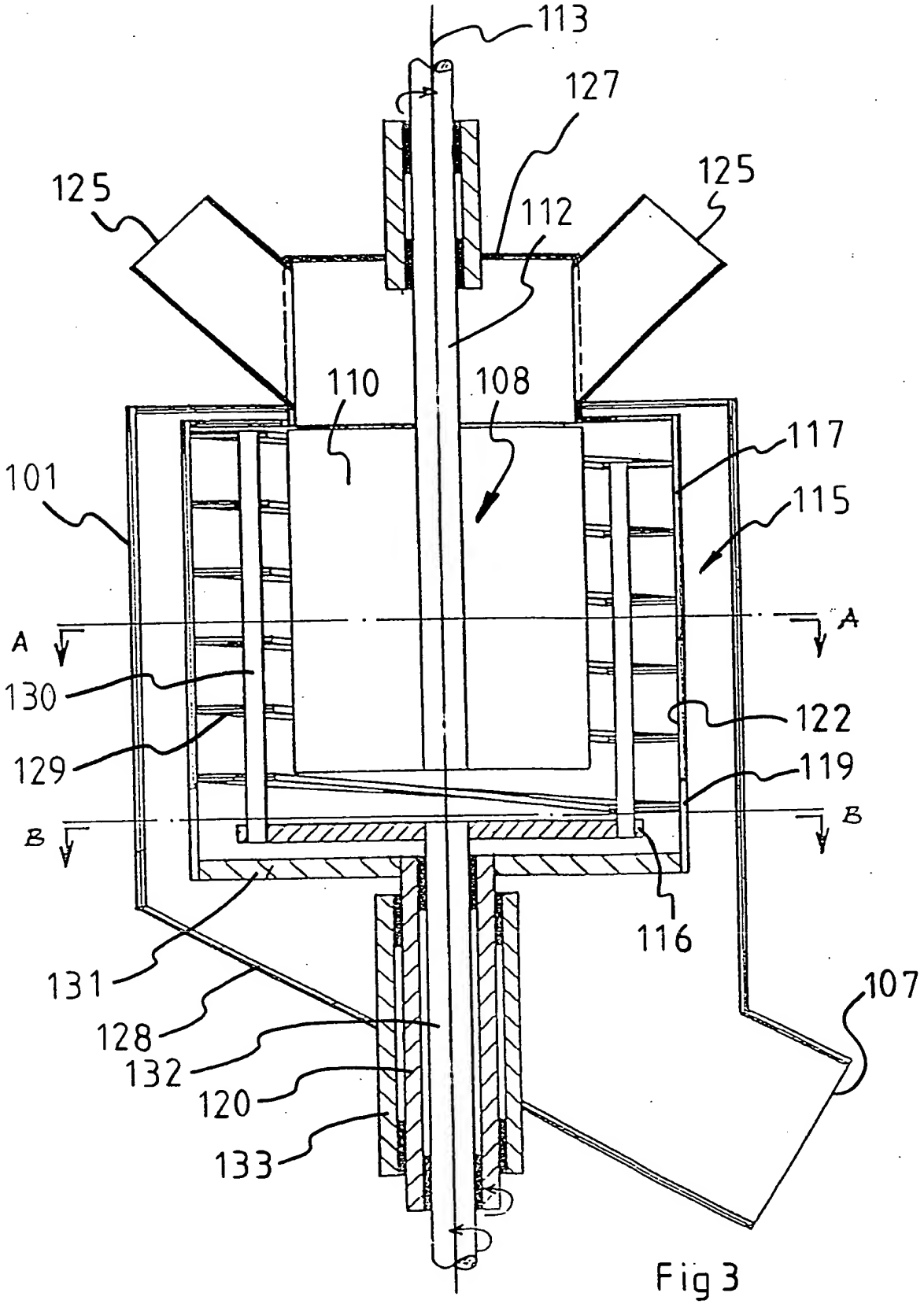
113
127
125
125
112
110
108
117
101
115
A
A
130
122
129
119
B
B
116
131
107
128
132
120
133

Fig 3

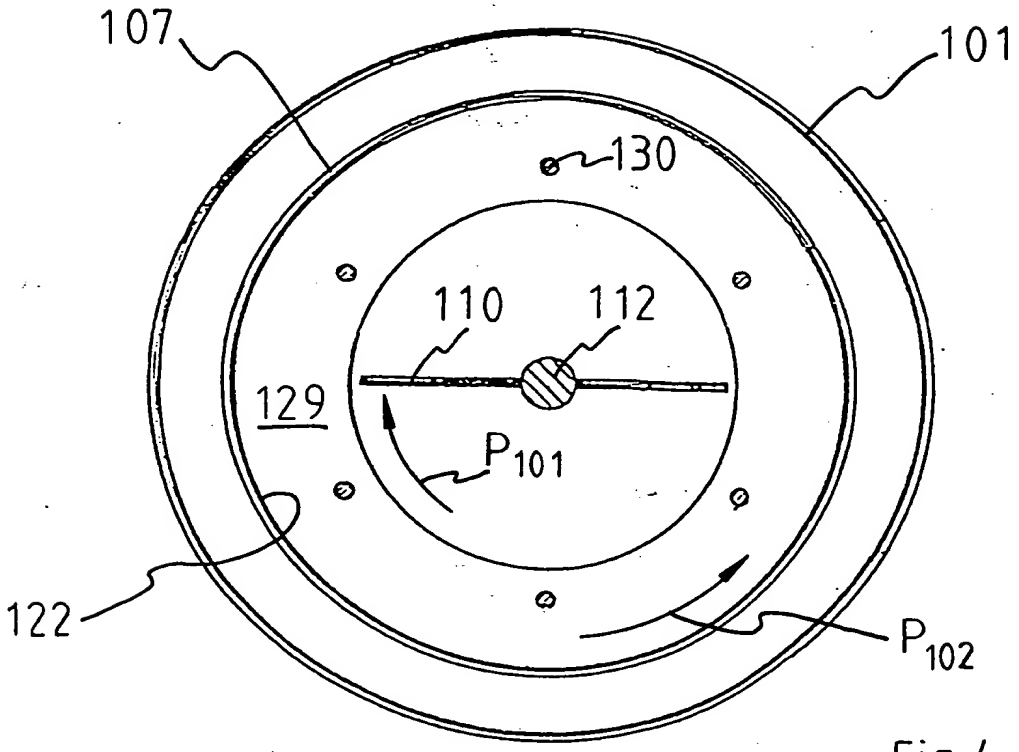

Fig 4

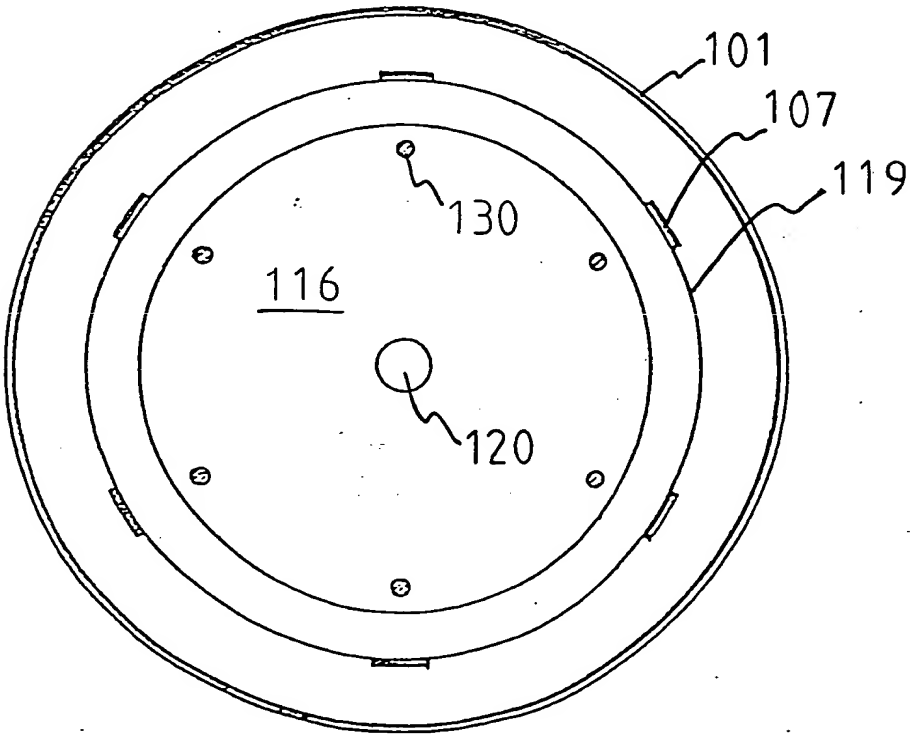

Fig 5

ANORDNING OCH METOD FÖR KONTINUERLIG BLANDNING

Tekniskt område

Föreliggande uppfinning avser en anordning och en metod för blandning av komponenter, och närmare bestämt en anordning för kontinuerlig blandning av åtminstone två komponenter, såsom vätskor och/eller pulver, innefattande ett första organ för sammanföring av komponenterna i skiktform och ett andra organ för utmatning av de sammanförda komponenterna under samtidig deformering av en vid sammanföringen erhållen skiktstruktur för åstadkommande av en homogen komponentblandning, samt en motsvarande metod för kontinuerlig blandning av åtminstone två komponenter.

Uppfinningens bakgrund

Det vanligaste sättet för blandning av komponenter, såsom vätskor och/eller pulver, är att sammanföra komponenterna i ett kärl och utsätta dem för omröring. Detta sätt lämpar sig emellertid inte för kontinuerlig blandning, och vidare blir blandningen slumpartad, varigenom en homogen komponentblandning inte kan tillförsäkras. Resultatet blir i stor utsträckning beroende på komponenternas blandningsbenägenhet.

Enligt en annan metod sammanföres skilda komponentdelflöden till ett gemensamt flöde, vilket sedan utsätts för turbulens. Detta sätt medger visserligen kontinuerlig blandning, men även här blir blandningen slumpartad och beroende av komponenternas blandningsbenägenhet.

För att lösa dessa problem har en metod utvecklats som medger kontinuerlig och nöjaktig blandning av komponenter, och därvid även blandning av icke blandningsbenägna komponenter. Enligt denna metod sammanföres komponenterna i skiktform, och de sålunda sammanförda komponenterna transporteras sedan vidare under deformering av den vid sammanföringen erhållna skiktstrukturen. Härige-

nom kan en kontinuerlig och homogen komponentblandning erhållas.

I DE 4 128 999 beskrivs en anordning som använder sig av den sistnämnda metoden. Anordningen medger blandning av två komponenter och innefattar två ringformade, smala kanaler, en för varje komponent. Kanalerna är anordnade mitt för varandra och möts vid en smal spalt. Komponenterna tillförs genom var sin kanal under relativt högt tryck, och sammanförs i form av ringformade skikt i spalten, varifrån de på så sätt sammanförda komponenterna leds vidare genom ytterligare en kanal. Under strömningen i den sistnämnda kanalen deformeras den vid sammanföringen erhållna skiktstrukturen och en homogen komponentblandning åstadkommes. Anordningen medger kontinuerlig blandning av icke blandningsbenägna komponenter, såsom exempelvis olja och vatten, varvid oljan tillförs under högre tryck än vattnet för bildande av en dispersion.

Anordningen uppvisar emellertid ett antal nackdelar. För det första medger anordningen inte blandning av fler än två komponenter. Vidare torde anordningen inte medge blandning av annat än vätskeformiga komponenter.

Ett första ändamål med föreliggande uppfinning är därför att åstadkomma en anordning som medger kontinuerlig blandning av två och fler komponenter, vilka komponenter kan vara vätskor och/eller pulver. Vätskor avses härvid även innefatta tixotropa och andra trögflytande material.

Ett andra ändamål med uppfinningen är att åstadkomma en metod för kontinuerlig blandning av två och fler komponenter, såsom vätskor och/eller pulver. Vätskor avses återigen innefatta även tixotropa och andra trögflytande material

Sammanfattning av uppfinningen

För uppnående av det första ändamålet anvisas enligt uppfinningen en anordning för kontinuerlig blandning en-

ligt krav 1. Föredragna utföringsformer av anordningen framgår av kraven 2-16.

För uppnående av det andra ändamålet anvisas enligt uppfinningen en metod enligt krav 17. En föredragen utföringsform av metoden framgår av krav 18.

Närmare bestämt anvisas enligt uppfinningen en anordning för kontinuerlig blandning av åtminstone två komponenter, såsom vätskor och/eller pulver, innefattande ett första organ för sammanföring av komponenterna i skiktform och ett andra organ för utmatning av de sammanförda komponenterna under samtidig deformering av en vid sammanföringen erhållen skiktstruktur för åstadkommande av en homogen komponentblandning, vilken anordning är kännetecknad av att det första organet innefattar ett skiktläggningsorgan och ett kring en geometrisk längdaxel roterbart mottagningsorgan med en mottagningsyta, som är vänd mot och anordnad radiellt utvändigt om skiktläggningsorganet, varvid skiktläggningsorganet är inrättat att växelvis förlägga komponenterna i form av tunna skikt på mottagningsytan för bildande av ett lager med skiktstruktur och varvid mottagningsorganet under rotation därav är inrättat för uppbärande av nämnda lager.

Blandningsförhållandet mellan komponenterna bestäms redan vid sammanföringen av komponenterna, och således är blandningsförhållandet mycket enkelt att styra genom styrning av respektive komponentflöde till skiktläggningsorganet.

Dessutom är antalet komponenter inte begränsat till två, och ej heller erfordras att komponenterna är vätskeformiga.

Genom variering av komponentskiktens utdragning i längsled, dvs genom variering av mottagningsorganets vinkelhastighet relativt skiktläggningsorganet, kan blandningsintensiteten varieras. En hög relativ vinkelhastighet mellan skiktläggningsorganet och mottagningsorganet åstadkommer en hög blandningsintensitet, vilket medger blandning av komponenter som inte är blandningsbenägna.

Härigenom medges exempelvis kontinuerlig blandning av tixotropa komponenter, såsom messmör och mjukost, vilka komponenter icke är blandningsbenägna.

Vidare medges kontinuerlig blandning av komponenter i olika faser, varigenom exempelvis blandning av en komponent i vätskeform och en komponent i pulverform medges.

Nämnda andra organ verkar såsom ovan anges för utmatning av de sammanförda komponenterna under samtidig deformering av den vid sammanföringen erhållna skiktstrukturen. Ett sätt att åstadkomma detta är att låta det andra organet mekaniskt ingripa med skiktstrukturen för frammatning samt för åstadkommande av en hopskrynkling av densamma. Det andra organet kan också vara anordnat att leda fram skiktstrukturen i en kanal under turbulent strömning, vilket också resulterar i en hopskrynkling av skiktstrukturen, vilket tillförsäkrar en homogen komponentblandning.

Skiktläggningsorganet kan vara roterbart kring nämnda geometriska längdaxel, och företrädesvis är skiktläggningsorganet roterbart med en första vinkelhastighet och är mottagningsorganet roterbart med en andra, från den första vinkelhastigheten skild vinkelhastighet. Vidare är skiktläggningsorganet fördelaktigt roterbart i en rotationsriktning som är motsatt den rotationsrikting, i vilken mottagningsorganet är roterbart. Härigenom kan en hög relativ vinkelhastighet mellan skiktläggningsorganet och mottagningsorganet åstadkommas, vilket således medger blandning av icke blandningsbenägna komponenter.

Företrädesvis är skiktläggningsorganet roterbart med en vinkelhastighet inom intervallet 30-85 rad/s och är mottagningsorganet roterbart med en vinkelhastighet inom intervallet 30-85 rad/s.

Skiktläggningsorganet kan innefatta ett munstycke för var och en av komponenterna, varvid varje munstycke är inrättat att förlägga tunna skikt av den därtill tillförda komponenten på mottagningsytan.

Skiktläggningsorganet kan alternativt innefatta ett kring nämnda geometriska längdaxel roterbart vingorgan, vilket under rotation därav är inrättat att ingripa med de därtill tillförda komponenterna och därefter slunga i väg dem för att förlägga tunna skikt av komponenterna på mottagningsytan.

Enligt en första föredragen utföringsform av uppfinningen är mottagningsorganet inrättat för överföring av lagret till det andra organet, och närmare bestämt kan mottagningsorganet innefatta en kropp med en koniskt utformad och koncentriskt kring den geometriska längdaxeln anordnad inre mantelyta, som således omsluter skiktläggningsorganet och bildar nämnda mottagningsyta, varvid mottagningsorganet under rotation därav och under inverkan av centrifugalkrafter är inrättat att föra nämnda lager mot den bredare änden hos den koniskt utformade mottagningsytan, vid vilken ände lagret blir överfört till det andra organet.

Under användning av en sålunda utformad anordning där nämnda bredare ände hos mottagningsytan är vänd nedåt medges sammanföring av vätskeformiga komponenter. Mottagningsorganets rotation ger härvid upphov till centrifugalkrafter, vilka bär upp det av komponenterna bildade lagret på mottagningsytan och samtidigt tillser att lagret kontinuerligt förs mot den bredare änden hos mottagningsytan för överföring till det andra organet. Någon eller några komponenter kan härvid också vara i pulverform.

Företrädesvis innefattar det andra organet en snäckformad kanal, som omsluter mottagningsorganet och uppvisar en mot mottagningsorganet öppen sida, varigenom det från mottagningsorganet kontinuerligt överförda lagret blir uppfångat av nämnda kanal. Det andra organet kan vidare innefatta unisont med mottagningsorganet roterbara utmatningsorgan och kanalen kan innefatta ett därtill anslutet utlopp, varvid utmatningsorganen är inrättade att transportera det till kanalen överförda lagret under de-

formering av dess skiktstruktur till utloppet. Företrädesvis innefattar varje utmatningsorgan en i mottagningsorganet fäst och i kanalen förflyttningsbar skovel, vilken under rotation av mottagningsorganet ingriper med det till kanalen överförda lagret och transporterar det under samtidig hopskrynkling därav mot utloppet.

Enligt en andra föredragen utföringsform av anordningen enligt uppfinningen innefattar det andra organet ett avskrapningselement för avskrapning av lagret från mottagningsytan, och mottagningsorganet är inrättat att under rotation därav överföra det sålunda avskrapade lagret till en utmatningsenhet hos det andra organet.

Företrädesvis innefattar mottagningsorganet en kropp med en cylindriskt utformad och koncentriskt kring den geometriska längdaxeln anordnad inre mantelyta, som således omsluter skiktläggningsorganet och bildar nämnda mottagningsyta, och är avskrapningselementet anordnat utmed mottagningsytan för avskrapning av lagret, varvid nämnda deformering av lagret åstadkommes under nämnda avskrapning.

Härigenom medges blandning av pulverkomponenter, varvid de av komponenterna bildade lagret är uppburet på mottagningsytan tack vare de på lagret genom mottagningsorganets rotation verkande centrifugalkrafterna.

Avskrapningselementet innefattar företrädesvis ett parallellt med den geometriska längdaxeln utsträckt skruvlinjeformat bandelement, som är anordnat utmed den cylindriskt utformade mottagningsytan, varvid bandelementet är roterbart med en tredje, från nämnda andra vinkelhastighet skild vinkelhastighet, varigenom det på mottagningsytan bildade lagret under rotation av såväl mottagningsorganet som bandelementet kontinuerligt transporteras till ett utmatningsläge, varifrån lagret blir överfört till utmatningsenheten hos det andra organet.

Vidare anvisas enligt föreliggande uppfinning en metod för blandning av åtminstone två komponenter, innefattande åtgärderna att i skiktform sammanföra komponenterna

och att därefter så transportera de sålunda sammanförda komponenterna att en vid sammanföringen erhållen skiktstruktur deformeras för bildande av en homogen komponentblandning, vilken metod är kännetecknad av att åtgärden att sammanföra komponenterna innefattar stegen att medelst ett skiktläggningsorgan växelvis förlägga tunna skikt av komponenterna på ett skiktläggningsorganet radiellt omslutande mottagningsorgan för bildande av ett lager med skiktstruktur och att genom rotation av mottagningsorganet bära upp lagret, varvid skikten i omkretsled förläggs jämnt på mottagningsorganet som en följd av dess rotation.

Företrädesvis roteras mottagningsorganet med en första vinkelhastighet och roteras skiktläggningsorganet med en från mottagningsorganets vinkelhastighet skild vinkelhastighet, varigenom skiktläggningsorganet ingriper med därtill tillförda komponenter och slungar dem i form av tunna skikt till mottagningsorganet.

En föredragen utföringsform av uppfinningen kommer nu i exemplifierande syfte att beskrivas under hänvisning till de medföljande figurerna.

Kort beskrivning av ritningarna

Fig 1 visar en tvärsnittsvy av en första utföringsform av en anordning enligt föreliggande uppfinning.

Fig 2 visar en tvärsnittsvy av anordningen längs linjen A-A i fig 1.

Fig 3 visar en tvärsnittsvy av en andra utföringsform av en anordning enligt föreliggande uppfinning.

Fig 4 visar en tvärsnittsvy av anordningen längs linjen A-A i fig 3.

Fig 5 visar en tvärsnittsvy av anordningen längs linjen B-B i fig 3.

Beskrivning av utföringsexempel

En i fig 1 och 2, vartill hänvisas, visad anordning för kontinuerlig blandning i enlighet med en första föredragen utföringsform av föreliggande uppfinning innefat-

tar ett hus 1, i vilket ett första organ för sammanföring av komponenter i skiktform och ett andra organ för utmatning av de sammanförda komponenterna under samtidig deformering av en vid sammanföringen erhållen skiktstruktur är anordnade. Det första organet innefattar närmare bestämt ett skiktläggningsorgan och ett mottagningsorgan, vilka är koncentriskt anordnade i huset 1. Det andra organet innefattar en snäckformad kanal 6 och skovelorgan 18.

Huset 1 innefattar en övre husdel 2 och en undre husdel 3. Den övre husdelen 2 är öppen i bägge ändar samt uppvisar en nedre fläns 4. Den undre husdelen 3 är likaså öppen i bägge ändar samt uppvisar en övre fläns 5. Flänsarna 4, 5 är anordnade mot varandra och bildar den snäckformade kanalen 6. Ett i fig 2 visat utloppsrör 7 är tangentiellt anslutet till nämnda kanal 6.

Skiktläggningsorganet innefattar en koncentriskt i huset 1 anordnad skiktläggningsrotor 8 med ett nav 9, som bär upp fyra, vinkelrätt mot varandra anordnade vingar 10. Navet 9 är fäst i en första ände hos en första drivaxel 12, som sträcker sig utmed en central geometriskt längdaxel 13 hos huset 1. En första remskiva 14 är fäst i den första drivaxelns 12 andra ände.

Mottagningsorganet innefattar en koncentriskt i huset 1 anordnad mottagningsrotor 15 med en väsentligen plan underdel 16 och en koniskt utformad ovandel 17, varvid ovandelens 17 bredare ände 11 är vänd nedåt. Ovandelen 17 är uppburen av underdelen 16 medelst skovelorganen 18 för bildande av en ringformad spalt 19 mellan de båda delarna 16, 17. Underdelen 16 är fäst i en första ände hos en andra drivaxel 20, vilken är ihålig och sträcker sig utvändigt om den första drivaxeln 12 utmed den geometriska längdaxeln 13. Den andra änden hos den andra drivaxeln 20 uppbär en andra remskiva 21. Underdelen 16 och den andra remskivan 21 är lagrade i den första drivaxeln 12.

De båda remskivorna 14, 21 är via ej visade remmar förbundna med ej visade drivorgan.

Mottagningsrotorn 15 är så anordnad i huset 1 att en koniskt utformad invändig mantelyta 22 hos mottagningsrotorn 15 i radiell riktning omsluter skiktläggningsrotorn 8.

De båda rotorerna 8, 15 är således inbördes koncentriska och roterbara relativt varandra medelst den första respektive den andra drivaxeln 12, 20.

Vidare är den andra drivaxeln 20 lagrad i huset 1. Slutligen är ett lock 23 med tillförselöppningar 24, 25 monterat i den övre husdelens 2 ovansida.

Under drift av anordningen drivs skiktläggningsrotorn 8 och mottagningsrotorn 15 medelst de ej visade drivorganen. Rotorerna 8, 15 roteras med skilda vinkelhastigheter ω_1 respektive ω_2 och företrädesvis i skilda rotationsriktningar P_1 respektive P_2. Exempel på endast exemplifierande vinkelhastigheter ω_1 respektive ω_2 är 30-85 rad/s för varje rotor 8, 15. Det inses emellertid att vinkelhastigheterna ω_1 respektive ω_2 måste anpassas till de komponenter som skall blandas, varför vissa komponenter kan erfordra såväl lägre som högre vinkelhastigheter.

De komponenter som skall blandas tillförs anordningen via tillförselöppningarna 24, 25. Härvid tillförs lämpligen komponenter i vätskeform via de smalare tillförselöppningarna 24 och eventuella komponenter i pulverform via den bredare tillförselöppningen 25.

Komponenterna leds till ett i huset 1 avgränsat utrymme 26, i vilket vingarna 10 hos skiktläggningsrotorn 8 är anordnade. När vingarna 10 roteras kommer de således att ingripa med de tillförda komponenterna och kasta tunna skikt av varje komponent i tangentiell framåtriktning (sett vinkelrätt mot skiktläggningsrotorns rotationsplan). De tunna skikten kommer att fångas upp av och förläggas på mottagningsrotorns 15 invändiga mantelyta 22. Skikten kommer att förläggas väsentligen växelvis och således bilda ett lager med skiktstruktur.

Lagret bärs upp av mottagningsrotorn 15 tack vare dess rotation. Vidare medför den koniska utformningen av mantelytan 22 att de på lagret verkande centrifugalkrafterna kontinuerligt leder lagret mot den bredare änden 11 hos mantelytan 22. När lagret når denna ände 11 kommer det att kastas i väg ut genom den ringformade spalten 19 och därvid uppfångas av den snäckformade kanalen 6.

Skovelorganen 18 är anordnade i den snäckformade kanalen 6 och roterar unisont med mottagningsrotorn 15. Skovelorganen 18 kommer således att färdas i nämnda kanal 6 och därvid ingripa med det i kanalen 6 anbringade lagret. Lagret transporteras av skovelorganen 18 under samtidig deformering eller hopskrynkling därav till utloppet 7. När lagret slutligen når utloppet 7 är följaktligen lagret så bearbetat att en homogen komponentblandning har åstadkommits. Det andra organet, dvs kanalen 6 och skovelorganen 18, verkar sålunda för utmatning av lagret med skiktstruktur under hopskrynkling av detsamma genom mekaniskt ingrepp.

För det fall att någon komponent är en pulverkomponent, tillförs den så som tidigare beskrivits genom den bredare tillförselöppningen 25. Denna tillförselöppning 25 är anordnad väsentligen centralt i locket 23. Härigenom tillförsäkras att vingarna 10 hos skiktläggningsrotorn 8 först förlägger skikt av vätskekomponenter, vilka följaktligen tillförs via de mindre och radiellt utvändigt anordnade tillförselöppningarna 24, och därefter skikt av pulverkomponenten på mantelytan 22. Härigenom åstadkommes en vätning av mantelytan 22, vilket underlättar förläggningen av pulverskikt.

Det inses att rotorernas 8, 15 rotationsriktningar P_1, P_2 inte med nödvändighet behöver vara motriktade. Det väsentliga är att den erforderliga relativa vinkelhastigheten mellan rotorerna 8, 15 uppnås, varvid den erforderliga relativa vinkelhastigheten är avhängig den eftersträvade blandningsintensiteten. En hög relativ vinkelhastighet medför att skikten blir utdragna i längsled,

vilket medför att en hög blandningsintensitet åstadkommes.

Tack vare den relativa vinkelhastigheten mellan rotorerna 8, 15 kommer komponentskikten att förläggas jämnt i omkretsled på mottagningsrotorns 15 invändiga mantelyta 22, även om intensitetsskillnader i vinkelled skulle föreligga hos komponentflödet från skiktläggningsrotorn 8.

I fig 3-5, vartill hänvisas, visas en anordning för kontinuerlig blandning enligt en andra föredragen utföringsform av föreliggande uppfinning.

Anordningen innefattar ett hus 101, i vilket ett första organ för sammanföring av komponenter i skiktform och ett andra organ för utmatning av de sammanförda komponenterna under samtidig deformering av en vid sammanföringen erhållen skiktstruktur är anordnade. Det första organet innefattar närmare bestämt ett skiktläggningsorgan och ett mottagningsorgan. Det andra organet innefattar ett avskrapningselement i form av ett bandelement 129. Huset 101 utgör även del av det andra organet. Huset 101 uppvisar tillförselöppningar 125 och ett utlopp 107 och skiktläggningsorganet och mottagningsorganet är koncentriskt anordnade kring en geometrisk längdaxel 113 i nämnda hus 101.

Skiktläggningsorganet innefattar en skiktläggningsrotor 108 med två vingar 110, vilka är fästa på motstående sidor hos en första ände hos en första drivaxel 112, vilken sträcker sig utmed den geometriska längdaxeln 113 och ut genom husets 101 ovansida 127. Drivaxelns 112 andra ände är via ett ej visat drivarrangemang förbunden med ett ej visat drivorgan.

Mottagningsorganet innefattar en mottagningsrotor 115, som är bildad av en cylinderdel 117, som är uppburen av en första bottenskiva 131. Cylinderdelen 117 uppvisar en invändig mantelyta 122, som i radiell riktning omsluter vingarna 110 hos skiktläggningsrotorn 108. Cylinderdelen 117 uppvisar vidare i omkretsled fördelade öppningar 119 i ett i angränsning till bottenskivan 131 befint-

ligt område, vilket klart framgår av fig 5. Bottenskivan 131 är fäst i en första ände hos en andra ihålig drivaxel 120, vilken är anordnad koncentriskt med den geometriska längdaxeln 113 och är utvändigt lagrad i en lagerdel 133 i husets 101 undersida 128. Den andra drivaxlen 120 sträcker sig ut genom husets 101 undersida 128 och dess andra ände är via ett ej visat drivarrangemang förbunden med ett ej visat drivorgan.

Det parallellt med den geometriska längdaxeln 113 utsträckta skruvlinjeformade bandelementet 129 är anordnat utmed den invändiga mantelytan 122 hos cylinderdelen 117. Bandelementet 129 är uppburet av stag 130, vilka i sin tur är fästa i en andra bottenskiva 116, som är fäst i en första ände hos en tredje drivaxel 132, som sträcker sig inuti den andra drivaxeln 120 utmed den geometriska längdaxeln 113. Den tredje drivaxeln 132 är utvändigt lagrad i den andra drivaxeln 120, och dess andra ände är via ett ej visat drivarrangemang förbunden med ett ej visat drivorgan.

Skiktläggningsrotorn 108, mottagningsrotorn 115 och bandelementet 129 är således koncentriskt anordnade kring den geometriska längdaxeln 113 och inbördes roterbara. Företrädesvis är skiktläggningsrotorn 108 roterbar i en första rotationsrikting P_{101} under det att mottagningsrotorn 115 och bandelementet 129 är roterbara i en andra rotationsriktning P_{102}. Vidare är bandelementet 129 roterbart med en från mottagningsrotorns 115 vinkelhastighet ω_{102} skild vinkelhastighet ω_{103}.

Under drift av anordningen roteras således skiktläggningsrotorn 108 i en första rotationsriktning P_{101} med en första vinkelhastighet ω_{101} under det att mottagningsrotorn 115 och bandelementet 129 roteras i en andra rotationsriktning P_{102} med en andra respektive en tredje vinkelhastighet ω_{102}, ω_{103}.

Komponenter i exempelvis pulverform tillförs anordningen via tillförselöppningarna 125, varvid vingarna 110 ingriper med pulverkomponenterna och växelvis förlägger

skikt av de olika komponenterna på cylinderdelens 117 mantelyta 122. Härigenom bildas ett lager med skiktstruktur på nämnda mantelyta 122. Tack vare den relativa rotationen mellan cylinderdelen 117 och bandelementet 129 kommer lagret att skrapas av från mantelytan 122 och transporteras till cylinderdelens 117 område med öppningar 119. Under nämnda transport kommer lagrets skiktstruktur att deformeras eller hopskrynklas för erhållande av en homogen komponentblandning. När lagret når öppningarna 119, kommer det att genom inverkan av centrifugalkrafter kastas i väg i tangentiell framåtriktning. Lagret kommer därefter att uppfångas av huset 101 och ledas vidare till utloppet 107, eventuellt under fortsatt deformering eller hopskrynkling därav.

Det inses att föreliggande uppfinning inte är begränsad till de visade utföringsformerna.

Exempelvis kan bandelementet ersättas av något annat avskrapningselement. Det väsentliga är att det på mantelytan bildade lagret överförs till huset och dess utlopp.

Det andra organet för utmatning av de sammanförda komponenterna under samtidig deformering av den vid sammanföringen erhållna skiktstrukturen, vilket andra organ beskrivits ovan under hänvisning till de visade utföringsformerna, verkar genom mekanisk påverkan av nämnda skiktstruktur. Skovelorganen 18 i fig 1 och 2 samt bandelementet 129 i fig 3 och 4 ingriper sålunda med skiktstrukturen och matar fram densamma under samtidig hopskrynkling. Det inses emellertid att nämnda matning under samtidig deformering kan åstadkommas på andra sätt. Det andra organet kan exempelvis vara anordnat att leda fram de sammanförda komponenterna i en kanal under turbulent strömning. Även här åstadkommes en hopskrynkling av skiktstrukturen, varigenom en homogen komponentblandning erhålles.

Vidare är det möjligt att ersätta skiktläggningsrotorn hos det första organet med munstycken, vilka är inrättade att förlägga var sitt komponentskikt på mottag-

ningsrotorn. Munstyckena kan antingen vara stationära eller roterbara.

Det är också möjligt att vända den med hänvisning till fig 1 och 2 beskrivna mottagningsrotorn så att den bredare änden vänds uppåt. Det på mottagningsrotorns mottagningsyta påförda lagret kommer likväl att transporteras till den bredare änden som en följd av centrifugalkrafternas påverkan på lagret.

Slutligen inses att antalet vingar hos skiktläggningsrotorn kan variera. Antalet komponentskikt som förläggs på mottagningsorganet per varv hos skiktläggningsrotorn är delvis en funktion av antalet vingar. Således kan blandningsintensiteten påverkas genom variering av antalet vingar hos skiktläggningsrotorn.

De visade utföringsformerna kan följaktligen modifieras och ändras utan att man avviker från uppfinningens omfattning, som definieras endast av de bifogade kraven.

PATENTKRAV

1. Anordning för kontinuerlig blandning av åtminstone två komponenter, såsom vätskor och/eller pulver, innefattande

ett första organ (8, 15; 108, 115) för sammanföring av komponenterna i skiktform och

ett andra organ (6, 18; 101, 129) för utmatning av de sammanförda komponenterna under samtidig deformering av en vid sammanföringen erhållen skiktstruktur för åstadkommande av en homogen komponentblandning,

k ä n n e t e c k n a d av att det första organet (8, 15; 108, 115) innefattar

ett skiktläggningsorgan (8; 108) och

ett kring en geometrisk längdaxel (13; 113) roterbart mottagningsorgan (15; 115) med en mottagningsyta (22; 122), som är vänd mot och anordnad radiellt utvändigt om skiktläggningsorganet (8; 108),

varvid skiktläggningsorganet (8; 108) är inrättat att växelvis förlägga komponenterna i form av tunna skikt på mottagningsytan (22; 122) för bildande av ett lager med skiktstruktur och

varvid mottagningsorganet (15; 115) under rotation därav är inrättat för uppbärande av nämnda lager.

2. Anordning enligt krav 1, k ä n n e t e c k n a d av att även skiktläggningsorganet (8; 108) är roterbart kring nämnda geometriska längdaxel (13; 113).

3. Anordning enligt krav 2, k ä n n e t e c k n a d av att skiktläggningsorganet (8; 108) är roterbart i en rotationsriktning (P_1; P_{101}) som är motsatt den rotationsrikting (P_2; P_{102}), i vilken mottagningsorganet (15; 115) är roterbart.

4. Anordning enligt krav 2 eller 3, k ä n n e t e c k n a d av skiktläggningsorganet (8; 108) är roterbart med en första vinkelhastighet (ω_1; ω_{101}) och mottagningsorganet (15; 115) är roterbart med en andra, från

den första vinkelhastigheten (ω_1; ω_{101}) skild vinkelhastighet (ω_2; ω_{102}).

5. Anordning enligt krav 4, k ä n n e t e c k n a d av att den första vinkelhastigheten (ω_1; ω_{101}) är inom intervallet 30-85 rad/s

6. Anordning enligt krav 4 eller 5, k ä n n e t e c k n a d av att den andra vinkelhastigheten (ω_2; ω_{102}) är inom intervallet 30-85 rad/s.

7. Anordning enligt något av de föregående kraven, k ä n n e t e c k n a d av skiktläggningsorganet innefattar ett munstycke för var och en av komponenterna, varvid varje munstycke är inrättat att förlägga tunna skikt av den därtill tillförda komponenten på mottagningsytan (22; 122).

8. Anordning enligt något av kraven 2-6, k ä n n e t e c k n a d av att skiktläggningsorganet (8; 108) innefattar ett kring nämnda geometriska längdaxel (13; 113) roterbart vingorgan (10; 110), vilket under rotation därav är inrättat att ingripa med de därtill tillförda komponenterna och därefter slunga i väg dem för förläggning av tunna skikt av komponenterna på mottagningsytan (22; 122).

9. Anordning enligt något av de föregående kraven, k ä n n e t e c k n a d av att mottagningsorganet (15) är inrättat för överföring av lagret till det andra organet (6, 18).

10. Anordning enligt krav 9, k ä n n e t e c k n a d av att mottagningsorganet (15) innefattar en kropp (17) med en koniskt utformad och koncentriskt kring den geometriska längdaxeln (13) anordnad inre mantelyta (22), som således omsluter skiktläggningsorganet (8) och bildar nämnda mottagningsyta (22), varvid mottagningsorganet (15) under rotation därav och under inverkan av centrifugalkrafter är inrättat att föra nämnda lager mot den bredare änden (11) hos den koniskt utformade mottagningsytan (22), vid vilken ände (11) lagret blir överfört till det

andra organet (6, 18) som en följd av mottagningsorganets (15) rotation.

11. Anordning enligt krav 10, k ä n n e t e c k n a d av att det andra organet (6, 18) innefattar en snäckformad kanal (6), som omsluter mottagningsorganet (15) och uppvisar en mot mottagningsorganet (15) öppen sida, varigenom det från mottagningsorganet (15) kontinuerligt överförda lagret blir uppfångat av nämnda kanal (6).

12. Anordning enligt krav 11, k ä n n e t e c k n a d av att det andra organet (6, 18) innefattar unisont med mottagningsorganet (15) roterbara utmatningsorgan (18) och att kanalen (6) innefattar ett därtill anslutet utlopp (7), varvid utmatningsorganen (18) är inrättade att transportera det till kanalen (6) överförda lagret under deformering av dess skiktstruktur till utloppet (7).

13. Anordning enligt krav 12, k ä n n e t e c k n a d av att varje utmatningsorgan (18) innefattar en i mottagningsorganet (15) fäst och i kanalen (6) förflyttningsbar skovel (18), vilken under rotation av mottagningsorganet (15) ingriper med det till kanalen (6) överförda lagret och transporterar det under samtidig hopskrynkling därav mot utloppet (7).

14. Anordning enligt något av kraven 1-8, k ä n n e t e c k n a d av att det andra organet (101, 129) innefattar ett avskrapningselement (129) för avskrapning av lagret från mottagningsytan (122) och att mottagningsorganet (115) är inrättat att under rotation därav överföra det sålunda avskrapade lagret till en utmatningsenhet (101) hos det andra organet (101, 129).

15. Anordning enligt krav 14, k ä n n e t e c k n a d av att mottagningsorganet (115) innefattar en kropp (117) med en cylindriskt utformad och koncentriskt kring den geometriska längdaxeln (113) anordnad inre mantelyta (122), som således omsluter skiktläggningsorganet (108) och bildar nämnda mottagningsyta (122), och att avskrapningselementet (129) är anordnat utmed mottagningsytan (122) för avskrapning av lagret från mottagningsytan

(122), varvid nämnda deformering av lagret åstadkommes under nämnda avskrapning.

16. Anordning enligt krav 15, k ä n n e t e c k n a d av att avskrapningselementet (129) innefattar ett parallellt med den geometriska längdaxeln (113) utsträckt skruvlinjeformat bandelement (129), som är anordnat utmed den cylindriskt utformade mottagningsytan (122), varvid mottagningsorganet (115) är roterbart med en andra vinkelhastighet och varvid bandelementet (129) är roterbart kring den geometriska längdaxeln (113) med en tredje, från nämnda andra vinkelhastighet (ω_{102}) skild vinkelhastighet (ω_{103}), varigenom det på mottagningsytan (122) bildade lagret under rotation av såväl mottagningsorganet (122) som bandelementet (129) kontinuerligt transporteras till ett utmatningsläge (119), varifrån lagret blir överfört till utmatningsenheten (101) hos det andra organet (101, 129).

17. Metod för blandning av åtminstone två komponenter, innefattande åtgärderna

att i skiktform sammanföra komponenterna och

att därefter så transportera de sålunda sammanförda komponenterna att en vid sammanföringen erhållen skiktstruktur deformeras för bildande av en homogen komponentblandning,

k ä n n e t e c k n a d av att

åtgärden att sammanföra komponenterna innefattar stegen

att medelst ett skiktläggningsorgan (8; 108) växelvis förlägga tunna skikt av komponenterna på ett skiktläggningsorganet (8; 108) radiellt omslutande mottagningsorgan (15; 115) för bildande av ett lager med skiktstruktur och

att genom rotation av mottagningsorganet (15; 115) bära upp lagret,

varvid skikten i omkretsled fördelas jämnt på mottagningsorganet (15; 115) som en följd av dess rotation.

18. Metod enligt krav 17, k ä n n e t e c k n a d av åtgärden att rotera skiktläggningsorganet (8; 108) med en första vinkelhastighet (ω_1; ω_{101}) och att rotera mottagningsorganet (15; 115) med en från skiktläggningsorganets (8; 108) vinkelhastighet (ω_1; ω_{101}) skild vinkelhastighet (ω_2; ω_{102}), varigenom skiktläggningsorganet (8; 108) ingriper med därtill tillförda komponenter och slungar dem i form av tunna skikt till mottagningsorganet (15; 115).

SAMMANDRAG

En anordning för kontinuerlig blandning av åtminstone två komponenter, såsom vätskor och/eller pulver. Anordningen innefattar ett första organ (8, 15) för sammanföring av komponenterna i skiktform och ett andra organ (6, 18) för utmatning av de sammanförda komponenterna under samtidig deformering av en vid sammanföringen erhållen skiktstruktur för åstadkommande av en homogen komponentblandning. Anordningen är kännetecknad av att det första organet (8, 15) innefattar ett skiktläggningsorgan (8) och ett kring en geometrisk längdaxel (13) roterbart mottagningsorgan (15) med en mottagningsyta (22), som är vänd mot och anordnad radiellt utvändigt om skiktläggningsorganet (8). Skiktläggningsorganet (8) är inrättat att växelvis förlägga komponenterna i form av tunna skikt på mottagningsytan (22) för bildande av ett lager med skiktstruktur och mottagningsorganet (15) är under rotation därav inrättat för uppbärande av nämnda lager. Föreliggande uppfinning avser även en metod för kontinuerlig blandning av åtminstone två komponenter.